MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

Spectral Gamma-Ray Borehole Log Data Report

Log Event A

Borehole 10-01-01

Borehole Information

Farm : A	**Tank :** A-101	**Site Number :** 299-E25-97
N-Coord : 41,247	**W-Coord :** 47,781	**TOC Elevation :** 689.09
Water Level, ft :	**Date Drilled :** 2/28/62	

Casing Record

Type : Steel-welded	Thickness, in. : 0.280	ID, in. : 6
Top Depth, ft. : 0	Bottom Depth, ft. : 125	

Cement Bottom, ft. : 18 **Cement Top, ft. :** 0

Borehole Notes:

Borehole 10-01-01 was originally drilled in February 1962 and completed at a depth of 75 ft with 6-in. casing. In 1978, the borehole was extended and completed at a depth of 125 ft. The driller's log notes that the original 6-in. casing was removed, inspected, and reinstalled before the borehole was extended. The condition of the casing was not mentioned; presumably, because it was considered to be satisfactory for reinstallation. The borehole was deepened by installing a temporary 8-in. surface casing to a depth of 18 ft and then driving the original 6-in. casing, and additional pipe as necessary, to a depth of 130 ft. The casing was then retracted for 5 ft and 9 gal of grout was placed in the bottom 5 ft of the borehole. The 8-in. temporary surface casing was removed and 63 gal of grout was added to the void space between the permanent 6-in. casing and the 8-in.-diameter portion of the borehole wall.

"As-built" drawings for the A Tank Farm indicate the original borehole was constructed with 6-in., schedule-30 pipe; however, this type of pipe was not identified in applicable engineering references. The casing thickness for the borehole is assumed to be 0.280 in., on the basis of the published thickness for schedule-40, 6-in. casing.

The top of the casing is the zero reference for the log. The casing lip is approximately even with the ground surface.

Equipment Information

Logging System : 1	**Detector Type :** HPGe	**Detector Efficiency:** 35.0 %
Calibration Date : 10/1996	**Calibration Reference :** GJO-HAN-13	**Logging Procedure :** P-GJPO-1783

Logging Information

Log Run Number : 1	**Log Run Date :** 01/08/1997	**Logging Engineer:** Alan Pearson
Start Depth, ft.: 0.0	**Counting Time, sec.:** 100	**L/R :** L **Shield :** N
Finish Depth, ft. : 18.0	**MSA Interval, ft. :** 0.5	**Log Speed, ft/min.:** n/a

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Log Run Number :	2	**Log Run Date :**	01/09/1997	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	124.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	39.5	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	3	**Log Run Date :**	01/10/1997	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	40.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	17.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Log Run Number :	4	**Log Run Date :**	01/10/1997	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	15.0	**Counting Time, sec.:**	100	**L/R :** L	**Shield :** N
Finish Depth, ft. :	0.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Logging Operation Notes:

This borehole was logged in four log runs. A 15-ft interval of the borehole was relogged as a quality assurance measure. The total logging depth achieved by the SGLS was 124.0 ft.

Analysis Information

Analyst : S.D. Barry

Data Processing Reference : MAC-VZCP 1.7.9 Analysis Date : 02/10/1998

Analysis Notes :

The pre- and post-survey field verification spectra for all logging runs met the acceptance criteria established for peak shape and system efficiency. The energy calibration and peak-shape calibration from these spectra were used to establish the peak resolution and channel-to-energy parameters used in processing the spectra acquired during the logging operation.

Casing correction factors for a 0.280-in.-thick steel casing (based on a 6-in., schedule-40 pipe) were applied to the entire logged interval during the analysis process.

Log Plot Notes:

Separate log plots show the man-made and the naturally occurring radionuclides. The natural radionuclides can be used for lithology interpretations. The headings of the plots identify the specific gamma rays used to calculate the concentrations. Uncertainty bars on the plots show the statistical uncertainties for the measurements as 95-percent confidence intervals. Open circles on the plots give the MDL. The MDL of a radionuclide represents the lowest concentration at which positive identification of a gamma-ray peak is statistically defensible.

A combination plot includes the man-made and natural radionuclides, the total gamma derived from the spectral data, and the Tank Farms gross gamma log. The gross gamma plot displays the latest available digital data. No attempt has been made to adjust the depths of the gross gamma logs to coincide with the

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SGLS data.

A separate plot shows the concentration of the man-made and naturally occurring radionuclides over the interval of the borehole in which the SGLS logging was repeated. The measured concentration and error bars showing the 95-percent confidence level as determined by the original and repeated logging runs are identified by symbols and colors. The measured concentrations determined by the original and repeated logging runs generally agree within the 2-sigma or 95-percent confidence level.

A separate plot of selected historical gross gamma-ray logs shows the changing gross gamma-ray activity over the time period that the gross gamma-ray logs were acquired.

Results/Interpretations:

The only man-made radionuclide detected in this borehole was Cs-137. Cs-137 contamination was detected continuously from the ground surface to 17.5 ft, just above the MDL at 26.5 ft, continuously from 80 to 81 ft, and intermittently to the bottom of the borehole.

The K-40 concentration values increase from 12 to 15 ft and remain elevated to a depth of about 57 ft. Between 57 and 60 ft, the K-40 concentrations sharply decrease, and then return to their previous values. A slight increase is shown on the K-40 log plot at a depth of about 70 ft. The U-238 log plot shows an interval of elevated concentrations between about 57 and 60 ft.

An analysis of the shape factors associated with applicable segments of the spectra was performed. The shape factors provide insights into the distribution of the Cs-137 contamination and into the nature of zones of elevated total count gamma-ray activity not attributable to gamma-emitting radionuclides. The shape factor analysis for the interval from the ground surface to about 15 ft is not valid because of the presence of grout on the outside of the borehole casing. Shape factor analysis results in the rest of the borehole were not interpretable.

The interval from the ground surface to 15 ft was relogged as a quality assurance measure. The comparison between the original log run and the rerun log was generally within the two sigma uncertainty, indicating the excellent repeatability of the logging measurement.

Additional information and interpretations of log data are included in the main body of the Tank Summary Data Report for tank A-101.